

# PATENT SPECIFICATION

(11)

1 329 177

## DRAWINGS ATTACHED

1 329 177

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(19)



## (54) PLATE HEAT EXCHANGERS

(71) We, FARBWERKE HOECHST AKTIEN-  
GESELLSCHAFT, vormals Meister Lucius &  
Brüning, a Body Corporate recognised under  
German Law, of 6230 Frankfurt (M) 80  
5 Hoechst, Germany, do hereby declare the  
invention, for which we pray that a patent  
may be granted to us, and the method by  
which it is to be performed, to be partic-  
ularly described in and by the following  
10 statement:—

This invention relates to plate heat ex-  
changers.

In order to effect heat exchange, which is  
15 necessary in industry in a great number of  
different chemical processes, various types  
of apparatus have been proposed, *inter alia*  
so-called plate heat exchangers. The hitherto  
20 proposed plate heat exchangers are made  
of corrosion resistant metallic materials of  
high quality.

It has been proposed to use polytetra-  
fluoroethylene as material for the manu-  
25 facture of heat exchangers to be used in  
aggressive and corrosive mediums, c.f., for  
example U.S. Patents Nos. 3,228,456;  
3,277,959; and 3,315,740. These hitherto  
30 proposed heat exchangers comprise tubes of  
polytetrafluoroethylene or materials con-  
taining polytetrafluoroethylene.

The present invention provides a plate  
heat exchanger including two outer flat  
35 sheets in spaced, parallel relationship, the  
inner face of each sheet being provided with  
one or more grooves, one or more inter-  
mediate flat sheets disposed between and  
parallel to the outer sheets, each face of the  
40 or each intermediate sheet being provided  
with one or more grooves, and a separating  
plate sandwiched between adjacent sheets  
and forming with the grooves ducts con-  
tained in parallel planes, the sheets and sepa-  
45 rating plates being provided with bores  
through their thickness interconnecting the  
ducts in alternate planes.

Two forms of plate heat exchanger ac-  
cording to the present invention will now  
be described by way of example only, with

reference to the accompanying drawings, in  
which:

Fig. 1 shows a top view of a sheet of one  
form of heat exchanger according to the  
invention and three sectional views along  
lines a—a, b—b and c—c, of the heat ex-  
changer.

Fig. 2 shows a top view of a sheet of  
another form of heat exchanger according  
to the invention and three sectional views  
along lines d—d, e—e and f—f, of the heat  
exchanger.

Fig. 3 shows a top view of a tube con-  
nection in a heat exchanger according to  
the present invention, and

Fig. 4 shows a cross sectional view of  
the tube connection shown in Fig. 3.

The ducts in alternate planes may be  
connected in series as is shown in section  
b—b of Fig. 1, or in parallel as is shown in  
section e—e of Fig. 2.

Referring generally to the drawings, the  
heat exchanger comprises a pack comprising  
a sheet 1 made of polytetrafluoroethylene  
having meandering grooves on both sides,  
sheets 2 made of polytetrafluoroethylene hav-  
ing meandering grooves on one side only  
and positioned on either side of the sheet 1,  
and polytetrafluoroethylene plates 3 clamped  
between the sheets 1 and 2 through which  
plates the heat exchange takes place. The  
pack of plates and sheets is held together by  
means of two terminal steel plates 4 and  
corresponding tie rods 5. In the terminal  
plates two apertures 6 and 7 are provided  
for connection sockets 9/10 for the inlet  
and outlet of the heat giving and heat-  
receiving media.

The sectional views show the ribs be-  
tween adjacent grooves exactly one on top  
of the other (i.e. the grooves are in register)  
so that the separating sheet may resist, if  
necessary, as high as possible a differential  
pressure of the two media. As the ducts  
may be fed in series or in parallel, the plate  
heat exchanger may easily be adapted to  
widely different conditions of quantity and  
operation, for example, the heat exchange

[Price 25p]

of liquid mediums, the condensation of vapours, or vaporization processes.

Referring to Figs. 3 and 4, the connection sockets 9/10 are pressed by means of divided rings 11/12, against polytetrafluoroethylene plates 8, which are provided with distribution channels.

The plate heat exchangers according to the invention may be manufactured from a variety of materials or material combinations, depending on the chemical or thermal stresses to be encountered in use.

Besides pure polytetrafluoroethylene, which has a low coefficient of thermal conductivity and a poor pressure resistance, there may be used co-polymers of tetrafluoroethylene or of polytetrafluoroethylene with other materials which have higher coefficients of thermal conductivity and withstand elevated pressures. Homo- and co-polymers of tetrafluoroethylene used preferably contain a filler, for example graphite. In certain cases, the plate and sheets of the heat exchanger may be manufactured completely or partially from other materials, for example ceramics, in which case the separating plates may be of metals or carbon.

#### WHAT WE CLAIM IS:—

1. A plate heat exchanger including two outer flat sheets in spaced, parallel relationship, the inner face of each sheet being provided with one or more grooves, one or 35 more intermediate flat sheets disposed between and parallel to the outer sheets, each face of the or each intermediate sheet being provided with one or more grooves, and a separating plate sandwiched between adjacent sheets and forming with the grooves

ducts contained in parallel planes, the sheets and separating plates being provided with bores through their thickness interconnecting the ducts in alternate planes.

2. A plate heat exchanger as claimed in claim 1 wherein the ducts in alternate planes are interconnected in series. 45

3. A plate heat exchanger as claimed in claim 1 wherein the ducts in alternate planes are interconnected in parallel. 50

4. A plate heat exchanger as claimed in any one of claims 1 to 3 wherein the grooves on either side of a separating plate are in register. 55

5. A plate heat exchanger as claimed in any one of claims 1 to 4 wherein each sheet is provided with meandering grooves. 60

6. A plate heat exchanger as claimed in any one of claims 1 to 5 wherein the sheets and separating plates are made of a homo- or copolymer of tetrafluoroethylene or of a material containing polytetrafluoroethylene. 65

7. A plate heat exchanger as claimed in claim 6 wherein the homo- or copolymer of tetrafluoroethylene contains a filler. 70

8. A plate heat exchanger as claimed in claim 7, wherein the filler is graphite.

9. A plate heat exchanger as claimed in claim 1 substantially as described herein with reference to and as illustrated in the accompanying drawings. 75

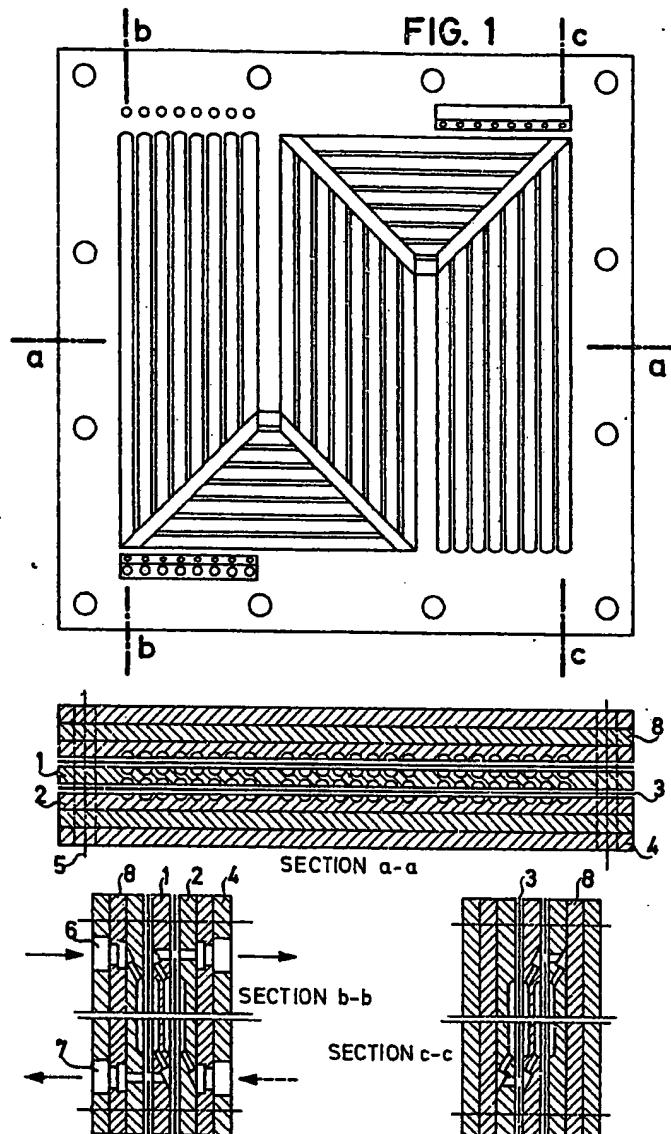
10. Apparatus which includes a plate heat exchanger as claimed in any one of claims 1 to 9.

ABEL & IMRAY,  
Chartered Patent Agents,  
Northumberland House,  
303-306 High Holborn,  
London, WC1V 7LH.

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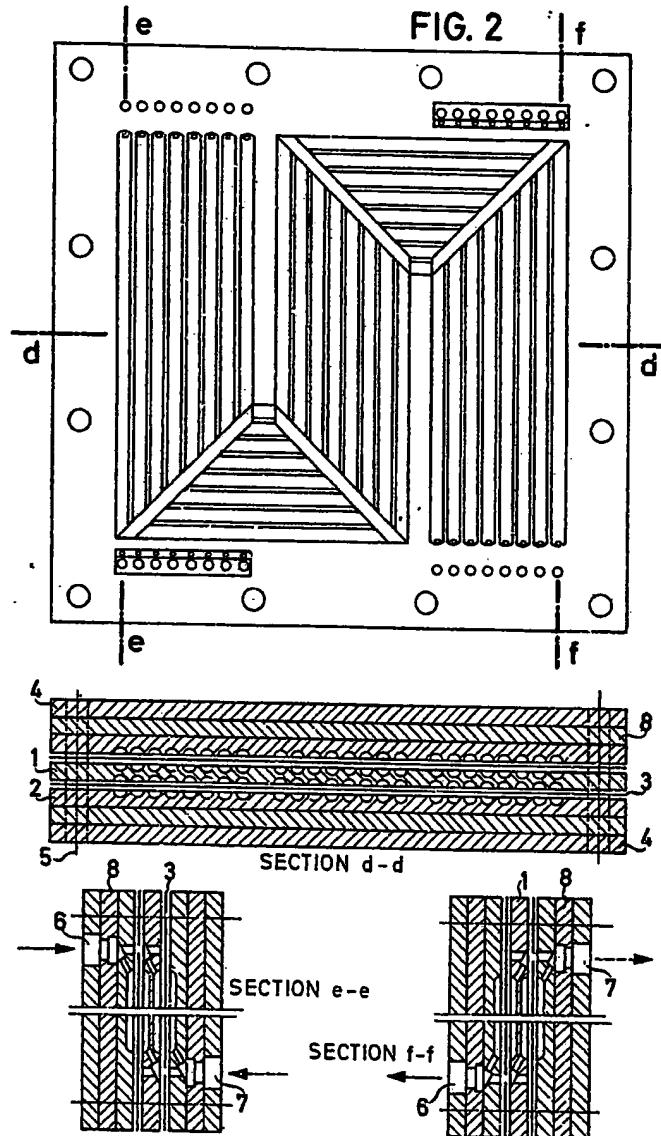
1329177 COMPLETE SPECIFICATION

3 SHEETS This drawing is a reproduction of  
the Original on a reduced scale  
Sheet 1



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Sheet 3

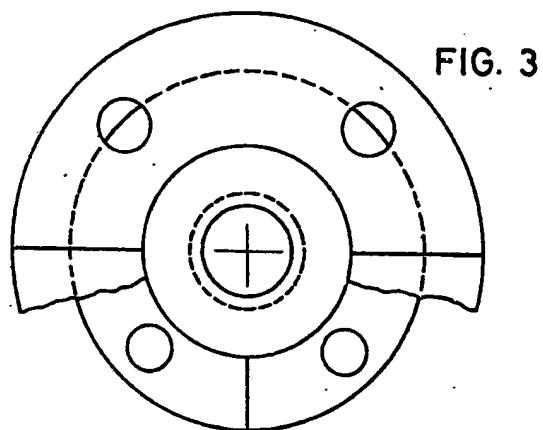


FIG. 3

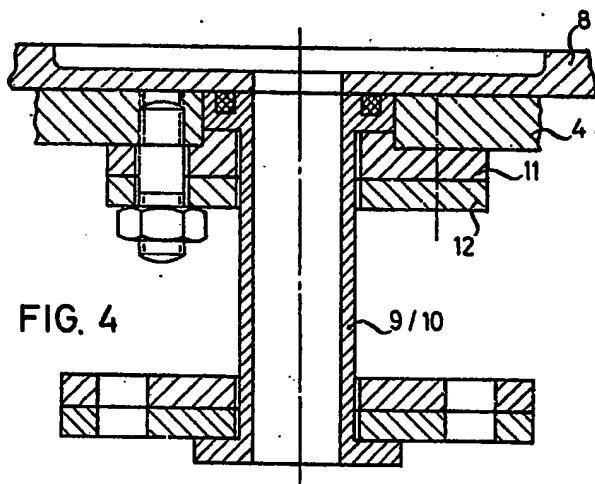


FIG. 4